WHAT IS CLAIMED IS:

1. A method of depositing a silica glass insulating film over a substrate, the method comprising:

exposing the substrate to a silicon-containing reactant introduced into a chamber in which the substrate is disposed such that one or more layers of the silicon-containing reactant are adsorbed onto the substrate;

purging or evacuating the chamber of the silicon-containing reactant;

converting the silicon-containing reactant into a silica glass insulating compound by exposing the substrate to oxygen radicals formed from a second reactant while biasing the substrate to promote a sputtering effect; and

repeating the exposing, purging/evacuating and exposing sequence a plurality of times.

2. The method of claim 1 wherein an average atomic mass of all atomic constituents in the second reactant is less than or equal to an average atomic mass of oxygen.

3. The method of claim 1 wherein the silicon-containing reactant is a silane family member having a formula of Si_nH_{2n+2}.

4. The method of claim 3 wherein the second reactant consists of molecular oxygen (O_2).

5. The method of claim 1 wherein the second reactant consists of molecular oxygen (O_2) and a sputtering agent.

6. The method of claim 5 wherein the sputtering agent consists of molecular hydrogen (H_2).

7. The method of claim 5 wherein the light weight sputtering agent comprises molecular hydrogen (H_2) and/or helium.

8. The method of claim 1 wherein the oxygen radicals are generated by forming a plasma within the chamber.

9. The method of claim 1 wherein the oxygen radicals are generated by forming a plasma in a remote plasma chamber.

10. The method of claim 1 wherein the chamber is evacuated of the silicon-containing reactant prior to exposing the substrate to oxygen radicals.

11. The method of claim 1 wherein the chamber is purged of the silicon-containing reactant by flowing a gas that is chemically inert to silica glass into the chamber.

12. The method of claim 1 wherein the chamber is purged of the silicon-containing reactant by flowing an oxygen source into the chamber.

13. The method of claim 8 wherein energy is applied to the chamber to form a plasma from the second reactant while biasing the substrate and wherein no plasma is formed while the substrate is exposed to the silicon-containing reactant.

14. The method of claim 1 further comprising doping the silica glass film with a dopant.

15. A method of depositing a silica glass insulating film over a substrate having a gap formed between two adjacent raised features, the gap having a bottom surface and a sidewall surface, the method comprising:

exposing the substrate to a silicon-containing reactant introduced into a chamber in which the substrate is disposed such that one or more layers of the silicon-containing reactant are adsorbed onto the substrate;

purging or evacuating the chamber of the silicon-containing reactant;

converting the silicon-containing reactant into a silica glass insulating compound by exposing the substrate to a plasma formed from a second reactant comprising oxygen atoms while biasing the substrate to promote a sputtering effect, wherein an average atomic mass of all atomic constituents in the second reactant is less than or equal to an average atomic mass of oxygen; and

repeating the exposing, purging/evacuating and exposing sequence a plurality of times;

wherein the substrate is maintained at a temperature between 300-800°C during growth of the silica glass film and wherein the silica glass film grows up from the bottom surface of the gap at a rate greater than it grows inward on the sidewall surface of the gap.